

Protocol: Ozone Monitoring**Parks Where Protocol will be Implemented: MORA, NOCA, OLYM, SAJH****Justification/Issues being Addressed:**

Ozone is one of the most phytotoxic (poisonous to plants) air pollutants and causes considerable damage to vegetation throughout the world. Plants are more sensitive to ozone than humans. Many native plants in natural ecosystems are sensitive to ozone. The effects of ozone range from visible injury to the leaves and needles of deciduous trees and conifers to premature leaf loss, reduced photosynthesis, and reduced growth in sensitive plant species. These physiological changes can occur in the absence of foliar injury and vice versa. In a natural ecosystem many other factors such as soil moisture, presence of other air pollutants, insects or diseases, genetic make-up, topographical locations, and other environmental stresses can lessen or magnify the extent of ozone injury.

Although visible plant damage has not been documented in NCCN parks, ozone has been measured at Paradise on Mount Rainier at levels which may impair growth and periodically at levels above the national standards raising concerns about potential human health impacts to visitors and employees. Dr. Dan Jaffee, atmospheric scientist at the University of Washington recently reported an increase in background levels of ozone associated with Trans-Pacific air masses (pers.communication). Although ozone levels associated with regional sources have leveled or even decreased over the past decade, continued growth in the region, changes in emission sources over time (e.g., increased marine vessel traffic), increasing emissions from Asia, and global warming may result in increasing levels of ozone in the future.

Table 1: Objectives and Basic Approach

Category	Objective	Basic Approach
Continuous ozone monitoring	Determine status and trends in hourly, daily, seasonal, decadal ozone concentration in the most sensitive regions of two Class I Parks (2 in MORA, 1 in NOCA) ¹ One cooperative site is proposed in SAJH, in partnership with Canadian and Washington State air quality agencies	Continuous ozone monitors will be used for long term monitoring of air quality using NPS-ARD and EPA protocols, including strict QA/QC procedures.

¹ The NPS-ARD eliminated the OLYM continuous ozone monitor at Port Angeles, in Fy05 and propose to remove the NOCA station in FY06. However, State and local air regulators have plans to monitor ozone, seasonally at other locations within OLYM but the long-term status of these stations is unknown. There are no other ozone monitoring sites planned within NOCA at this time. Of the two monitoring stations within MORA, one is NPS operated and the other operated by the State.

Category	Objective	Basic Approach
Passive ozone monitoring	Determine status and trends in weekly, seasonal, and decadal ozone concentration in the most sensitive regions of MORA ²	Using NPS-ARD protocols, passive ozone monitors will be conducted annually during July through September where highest ozone levels have been modeled and monitored.
Biomonitoring for ozone damage	Determine status and trends in foliar damage to ozone sensitive vegetation species (vascular plants) during the growing season (June – September) to try to link ozone concentrations to visible changes in plant health	<p>Biomonitoring will be conducted in conjunction with passive ozone monitors at MORA. Biomonitoring of vegetation (foliar damage), will be conducted annually, during the growing season, in accordance with USFS FIA protocols.</p> <p>Objective criteria will be developed to determine when to conduct <u>periodic</u> biomonitoring at additional locations within the NCCN as part of a long term monitoring strategy that takes into account the potential for ozone to increase to levels at which visible vegetative damage may be observed.</p>

Principal Investigators and NPS Lead:

John Ray, NPS-ARD is the lead for the NPS continuous and passive ozone monitoring protocols.

Sally Campbell, USFS, Portland, is our contact for the ozone biomonitoring protocols.

WDOE is the lead for continuous ozone monitors operated by the State and local air regulators.

NCCN Lead :Barbara Samora (MORA)

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Development Schedule, Budget, and Expected Interim Products:

Existing NPS-ARD, EPA, and Washington State Department of Ecology protocols will be utilized for the continuous ozone monitors.

Existing NPS-ARD protocols will be utilized for passive ozone monitoring.

Existing USFS FIA monitoring protocols will be utilized for biomonitoring for ozone.

Schedule:

All protocols will be consolidated into one document by the end of 2005.

Budget:

FY05: \$4400.00 for a Biological Technician (2 pp) to pull together protocols into prescribed formats for Vital Sign Monitoring protocols.

² The NPS-ARD recently eliminated funding for all passive ozone monitoring. MORA ONPS funds are providing for continued operation of this program within MORA. However, funding may not be available for long-term monitoring in the future.